

CLAIMS

WE CLAIM:

1. A hand-held laser fusion welding assembly, comprising:
a main body dimensioned to be grasped by a hand and having at least one or more filler media delivery flow passages extending through the main body, the main body adapted to couple to at least a laser delivery system, and each main body filler media delivery flow passage adapted to receive a filler media therein; and
a nozzle coupled to the main body, the nozzle having at least an aperture through which laser light from the laser delivery system may pass, and one or more filler media delivery flow passages each in fluid communication with the main body filler media delivery flow passages, each nozzle filler media delivery flow passage extending through the nozzle and configured to supply filler media to a workpiece.
2. The assembly of Claim 1, further comprising:
one or more filler media liner tubes, each liner tube disposed at least partially within one of the main body filler media delivery flow passages.
3. The assembly of Claim 1, further comprising:
an end cap coupled to the main body second end, the end cap having an optical cable opening adapted to receive an optical cable, and one or more filler media delivery flow passages each in fluid communication with one of the main body filler media delivery flow passages.

4. The assembly of Claim 3, further comprising:
one or more filler media liner tubes, each liner tube disposed at least partially within one of the end cap filler media delivery flow passages and one of the main body filler media delivery flow passages.
5. The assembly of Claim 1, further comprising:
an optics assembly mounted within the main body and configured to focus the laser light from the laser delivery system on a point in front of the nozzle aperture.
6. The assembly of Claim 5, wherein the optics assembly comprises:
a lens conduit having at least a first end and a second end;
a first lens mounted within the lens conduit adjacent the lens conduit first end, the first lens configured to collimate the laser light from the laser delivery system; and
a second lens mounted within the lens conduit adjacent the lens conduit second end, the second lens configured to focus the collimated laser light on the point in front of the nozzle aperture.
7. The assembly of Claim 6, wherein at least the first lens is movably mounted within the lens conduit, and wherein the assembly further comprises:
a receptacle assembly mounted within the main body adjacent the lens conduit first end, the receptacle assembly adapted to receive an optical cable through which the laser light from the laser delivery system is transmitted; and
an optical adjustment screw movably mounted within the lens conduit adjacent the first lens, the optical adjustment screw configured to adjust a spacing between the first lens and the receptacle assembly, whereby the collimation of the delivered laser light is adjustable.

8. A laser fusion welding system, comprising:
 - a filler media delivery system configured to supply filler media;
 - an optical cable coupled to a laser delivery system and configured to transmit laser light therethrough; and
 - a hand-held laser fusion welding assembly including:
 - a main body dimensioned to be grasped by a hand and having at least one or more filler media delivery flow passages extending through the main body, the main body adapted to couple to the optical cable, and each main body filler media delivery flow passage coupled to receive the filler media supplied from the filler media delivery system, and
 - a nozzle coupled to the main body, the nozzle having at least an aperture through which laser light transmitted through the optical cable may pass, and one or more filler media delivery flow passages each in fluid communication with the main body filler media delivery flow passages, each nozzle filler media delivery flow passage extending through the nozzle and configured to supply the filler media supplied from the filler media supply system to a workpiece.
9. The system of Claim 8, further comprising:
 - one or more filler media liner tubes, each liner tube disposed at least partially within one of the main body filler media delivery flow passages, wherein the filler media supplied from the filler media delivery system either flows or extends through one or more of the liner tubes.
10. The system of Claim 8, further comprising:
 - an end cap coupled to the main body second end, the end cap having an optical cable opening through which the optical cable extends, and one or more filler media delivery flow passages each in fluid communication with one of the main body filler media delivery flow passages and coupled to receive the filler media supplied from the filler media delivery system.

11. The system of Claim 10, further comprising:
one or more filler media liner tubes, each liner tube disposed at least partially within one of the end cap filler media delivery flow passages and one of the main body filler media delivery flow passages,
wherein the filler media supplied from the filler media delivery system either flows or extends through one or more of the liner tubes.
12. The system of Claim 8, wherein the filler media delivery system comprises:
a wire feeder; and
one or more strands of wire filler media coupled to the wire feeder.
13. The system of Claim 8, wherein the filler media delivery system comprises:
a container having an inner volume;
powder filler media disposed within the container inner volume; and
one or more conduits, each conduit in fluid communication with the container inner volume and a main body filler media delivery flow passage.
14. The system of Claim 8, wherein the filler media delivery system comprises:
a container having an inner volume;
liquid filler media disposed within the container inner volume; and
one or more conduits, each conduit in fluid communication with the container inner volume and a main body filler media delivery flow passage.

15. The system of Claim 8, further comprising:
an optics assembly mounted within the main body and configured to focus the laser light from the laser delivery system on a point in front of the nozzle aperture.

16. The system of Claim 15, wherein the optics assembly comprises:
a lens conduit having at least a first end and a second end;
a first lens mounted within the lens conduit adjacent the lens conduit first end, the first lens configured to collimate the laser light from the laser delivery system; and
a second lens mounted within the lens conduit adjacent the lens conduit second end, the second lens configured to focus the collimated laser light on the point in front of the nozzle aperture.

17. The system of Claim 16, wherein at least the first lens is movably mounted within the lens conduit, and wherein the system further comprises:
an optical cable through which the laser light from the laser delivery system is transmitted;
a receptacle assembly mounted within the main body adjacent the lens conduit first end, the receptacle assembly coupled to the optical cable; and
an optical adjustment screw movably mounted within the lens conduit adjacent the first lens, the optical adjustment screw configured to adjust a spacing between the first lens and the receptacle assembly, whereby the collimation of the delivered laser light is adjustable.

18. A method of treating a surface of a workpiece using a hand-held laser welding wand, the method comprising the steps of:

directing a laser beam through the hand-held laser welding wand and onto the workpiece surface, to thereby create a melt pool on the workpiece surface;
supplying filler media from a filler media source to the workpiece surface;
and

controlling the wand and filler media source independent of one another.

19. The method of Claim 18, wherein the wand and filler media source are each manually controlled.

20. The method of Claim 19, wherein:
the wand is manually manipulated by a first hand of a user; and
the filler media source is manually manipulated by a second hand of the user.

21. The method of Claim 18, wherein the filler media is supplied to the work piece surface before the melt pool is created.

22. The method of Claim 21, wherein the filler media is selected from the group consisting of paint, paste, powder, and foil.

23. The method of Claim 18, wherein the filler media source is an automated filler media source.

24. The method of Claim 18, wherein:
the laser beam is directed through the hand-held laser welding wand along a first axis; and
the filler material is supplied to the workpiece surface along a second axis.